

CLAIMS:

Claim 1: A shock tube initiator for allowing the remote and/or manual initiation of at least one shock tube, wherein the shock tube initiator includes in combination:

- a) at least one coupling means operably connected to a shock tube and wherein the coupling means is adapted to house a shot shell primer containing an explosive charge that upon firing initiates burning of the shock tube,
- b) a cockable mechanical firing mechanism positioned proximal to and adjacent to the coupling means wherein the mechanical firing mechanism is adapted to ignite said explosive charge,
- c) a safety mechanism adapted to allow the mechanical firing mechanism to ignite said explosive charge only when the safety mechanism is moved from a safe mode position to an armed position,
- d) a rotary electro-mechanical energising means operably electrically connected to and energised by a remote controlled operating system, and
- e) an actuating means adapted to be positioned between and engageable with the rotary electro-mechanical energising means and the firing mechanism and wherein said actuating means is adapted to be actuated either by the rotary electro-mechanical energising means, when energised, or manually manipulated to allow the cockable mechanical firing mechanism when cocked, to fire and ignite said explosive charge to initiate burning of the at least one shock tube when the safety mechanism is in the armed position.

Claim 2: A shock tube initiator for allowing the remote and/or manual initiation of at least one shock tube, wherein the shock tube initiator includes in combination:

- a) at least one coupling means operably connected to a shock tube and wherein the coupling means is adapted to house a shot shell primer containing an explosive charge that upon firing initiates burning of the shock tube,
- b) a cockable mechanical firing mechanism positioned proximal and adjacent to the coupling means wherein the mechanical firing mechanism is adapted to ignite said explosive charge, and

- c) a rotary electro-mechanical energising means operably electrically connected to and energised by a remote controlled operating system wherein, in use, the mechanical firing mechanism when cocked is actuated either manually or by the energised rotary electro-mechanical energising means to cause the mechanical firing mechanism to fire and ignite the explosive charge to initiate burning of the shock tube.

Claim 3: The shock tube initiator as claimed in claim 2, wherein the shock tube initiator includes a safety mechanism adapted to allow the mechanical firing mechanism to fire and ignite the explosive charge only when the safety mechanism is moved from a safe mode position to an armed position.

Claim 4: The shock tube initiator as claimed in claim 3, wherein the shock tube initiator includes an actuating means adapted to be positioned between and engageable with the rotary electro-mechanical energising means and the firing mechanism and wherein the actuating means is adapted to be actuated either by the rotary electro-mechanical energising means, when energised, or manually manipulated to allow the cockable mechanical firing mechanism, when cocked, to fire and ignite said explosive charge when the safety mechanism is in the armed position.

Claim 5: The shock tube initiator as claimed in claim 1 or claim 4 wherein the shock tube initiator is a dual shock tube initiator having two shock tube coupling means, a first and second coupling means, wherein each shock tube coupling means is adapted to allow one end of a shock tube coupled thereto

Claim 6: The shock tube initiator as claimed in claim 5, wherein the rotary electro-mechanical energising means is a rotary solenoid having a rotary shaft adapted to engage with the actuating means.

Claim 7: The shock tube initiator as claimed in claim 6, wherein a cam having a camming surface is adapted to be positioned between the rotary shaft of the solenoid and the actuating means such that rotary motion of the rotary shaft, when the solenoid is energised, imparts, via the cam, a linear motion to the actuating means.

Claim 8: The shock tube initiator as claimed in claim 7, wherein the cam is a helical cam.

Claim 9: The shock tube initiator as claimed in claim 8, wherein the actuating means includes a first sear having one end adapted to be in connection with the cam and the other end having engaging surface adapted to engage with the mechanical firing mechanism so as to releasably retain the mechanical firing mechanism in a cocked state until the first sear is actuated, either by the energised solenoid or manually, whereby upon actuation the first sear is disengaged from the cocked mechanical firing mechanism so that the mechanical firing mechanism is able to fire and ignite said explosive charge.

Claim 10: The shock tube initiator as claimed in claim 9, wherein each coupling means includes a firing pin therein adapted, upon contact with the firing mechanism, to ignite said explosive charge so as to initiate burning of the shock tube coupled to the coupling means.

Claim 11: The shock tube initiator as claimed in claim 10, wherein the coupling means and firing pin are modular and interchangeable.

Claim 12: The shock tube initiator as claimed in claim 11, wherein the mechanical firing mechanism includes at least one rotating sprung loaded hammer rotatable from a cocked state under the action of biasing means to a firing state in which a face of the hammer is adapted to strike the firing pin to initiate ignition of said explosive charge.

Claim 13: The shock tube initiator as claimed in claim 12, wherein, the mechanical firing mechanism includes two sprung loaded hammers rotatable about a common axis such that a first hammer is adapted to strike a first firing pin in the first coupling means and the second hammer adapted to strike a second firing pin in the second coupling means.

Claim 14: The shock tube initiator as claimed in claim 13, wherein the engaging surface of the first sear is engageable with the first hammer so as to releasably retain the first hammer in said cocked state until the first sear is actuated.

Claim 15: The shock tube initiator as claimed in claim 14, wherein the actuation means includes a second sear positioned parallel in a spaced apart relationship to the first sear, wherein

the second sear includes an engaging surface engageable with the second hammer so as to releasably retain the second hammer in said cocked state until the first sear is actuated.

Claim 16: The shock tube initiator as claimed in claim 15, wherein the second sear includes an interrupter sear means adapted to upon actuation of the first sear and rotation of the first hammer to cause the second sear to disengage from the second hammer to allow the second hammer to rotate.

Claim 17: The shock tube initiator as claimed in claim 16, wherein the first sear is actuated by the solenoid when energised or actuated manually by a decocking means in contact with the first sear, wherein the decocking means is adapted upon manual manipulation to cause the first sear to disengage from the first hammer to allow the second hammer to rotate.

Claim 18: The shock tube initiator as claimed in claim 17, wherein the decocking means includes a rotatable lever adapted to rotate between two positions, wherein the first position the lever is in a safe mode position whereby the lever is in contact with the first sear so as to prevent the first sear disengaging from the first hammer and wherein the second position the lever is in an armed position whereby the lever causes the first sear to disengage from the first hammer to allow the first hammer to rotate.

Claim 19: The shock tube initiator as claimed in claim 18, wherein the decocking means when the lever is in the armed position prevents the hammers to be cocked or recocked.

Claim 20: The shock tube initiator as claimed in claim 19, wherein the mechanical firing mechanism has a cocking means adapted to rotate the hammers from an uncocked state to a cocked state.

Claim 21: The shock tube initiator as claimed in claim 20, wherein the cocking means includes a two-way cocking lever with a rotary cocking cam wherein rotation of the two-way cocking lever in a first direction causes the rotary cocking cam to rotate the first hammer from a uncocked state to a cocked state and subsequent rotation of the two-way cocking lever in a second direction causes the rotary cocking cam to rotate the second hammer from a uncocked state to a cocked state.

Claim 22: The shock tube initiator as claimed in claim 21, wherein the rotary cocking cam includes a circular disc having an upper surface with a central shaft coupled to the two-way cocking lever and having on a lower surface a cam shaft offset to the central axis of the circular disc wherein the offset cam shaft is adapted to engage with each respective hammer when the two-way cocking lever is rotated in said first and second directions.

Claim 23: The shock tube initiator as claimed in claim 22, wherein the circular disc has two spaced apart recesses on the outer circumferential edge of the circular disc wherein the two spaced apart recesses cooperate with the safety mechanism such that when the safety mechanism is in the safe mode position each recess engages with a respective shaft of the safety mechanism so that the hammers are unable to be fired unintentionally once the hammers are in the cocked state and when the safety mechanism is in the armed position the recesses are disengaged from the shafts of the safety mechanism to enable hammers to rotate from the cocked state to cause firing of the shock tube initiator upon actuation of the sear.

Claim 24: The shock tube initiator as claimed in claim 23, wherein the safety mechanism includes two rotatable safety levers that are rotateable between said safe mode position and said armed position wherein each safety lever has a shaft that is adapted to engage with a respective recess of the rotary cocking cam when the safety lever is in said safe mode position and is adapted to disengageable from the recess of the rotary cocking cam when the safety lever is in the armed position.

Claim 25: The shock tube initiator as claimed in claim 24, wherein the safety mechanism is adapted to be positioned between the first and second coupling means and the hammers so as to prevent contact between the hammers and the firing pins when the safety mechanism is in the safe mode position.

Claim 26: A method of use of a shock tube initiator including the steps of:

- a) placing a shot shell primer containing an explosive charge within at least one coupling means having a firing pin therein,

- b) coupling to the coupling means one end of a shock tube that has a blasting means at its other end,
- c) electrically connecting a rotary electro-mechanical energising means to a remote controlled operating system adapted to electrically energise the rotary electro-mechanical energising means upon the remote controlled operating system receiving an energising signal,
- d) cocking a mechanical firing mechanism positioned between the coupling means and the rotary electro-mechanical energising means, wherein the mechanical firing mechanism is adapted to fire the firing pin and ignite the explosive charge to initiate burning of the shock tube, and
- e) actuating firing of the mechanical firing mechanism by either:
 - i. sending an energising signal to the remote controlled operating system to electrically energise the rotary electro-mechanical energising means so that the energised rotary electro-mechanical energising means causes an actuating means positioned between the rotary electro-mechanical energising means and the mechanical firing mechanism to actuate the mechanical firing mechanism, or
 - i. manually operating the actuation means to actuate the mechanical firing mechanism.

Claim 27: A method of use of a shock tube initiator including the steps of:

- a) positioning a safety mechanism in a safe mode position to prevent the shock tube initiator from initiating,
- b) placing a shot shell primer containing an explosive charge within at least one coupling means having a firing pin therein,
- c) coupling to the coupling means one end of a shock tube that has a blasting means at its other end,
- d) electrically connecting a rotary electro-mechanical energising means to a remote controlled operating system adapted to electrically energise the rotary electro-mechanical energising means upon the remote controlled operating system receiving an energising signal,
- e) cocking a mechanical firing mechanism positioned between the coupling means and the rotary electro-mechanical energising means, wherein the mechanical firing mechanism is

- adapted to fire the firing pin and ignite the explosive charge to initiate burning of the shock tube,
- f) positioning the safety mechanism to an armed mode to allow the initiation of the shock tube initiator to commence, and
 - g) actuating firing of the mechanical firing mechanism by either:
 - i. sending an energising signal to the remote controlled operating system to electrically energise the rotary electro-mechanical energising means so that the energised rotary electro-mechanical energising means causes an actuating means positioned between the rotary electro-mechanical energising means and the mechanical firing mechanism to actuate the mechanical firing mechanism, or
 - ii. manually operating the actuation means to actuate the mechanical firing mechanism.